Ceres

Investing in the Future

Unlocking Value Through Avoided Emissions

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Acknowledgments

About Ceres

Ceres is a nonprofit advocacy organization working to accelerate the transition to a cleaner, more just, and sustainable world. United under a shared vision, our powerful networks of investors and companies are proving sustainability is the bottom line—changing markets and sectors from the inside out. For more information, visit ceres.org.

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Introduction

Avoided emissions are carbon emissions that will no longer be produced due to the replacement of a higher emitting technology, product, or service (higher emitting scenario) with a low-emitting technology, product, or service (low-emitting scenario). Avoided emissions are calculated by taking the emissions produced in the higher emitting scenario and subtracting the emissions produced in the low-emitting scenario that replaces or improves the higher one. The difference in emissions is the avoided emissions.

When Ceres conducted a landscape analysis of existing literature on avoided emissions, we found that most analysis has been done from a company's perspective rather than an investor's. As we spoke with asset owners and asset managers to determine the information investors need regarding avoided emissions, we learned that many investors were not familiar with the concept or were confused about what it represents and how it differs from simply reducing emissions. Others were reluctant to use it because the absence of a standardized calculation process might prompt questions about greenwashing or other misuse. Yet, most recognized the importance of communicating the impact of climate-positive investments.

As more investments are made to transition high-emitting, hard-to-abate sectors and to scale climate solutions (together, climate investments), these investments come with an upfront increase in the reported emissions to the investor but potentially enable a dramatically positive impact on emissions released into the atmosphere over time. Avoided emissions is a useful metric to capture that potential impact on emissions of those climate investments.

Avoided emissions can also be used to identify investment opportunities that are likely to be in high demand as we transition to a low-carbon economy. As companies move to reduce their carbon footprint, they do so by improving operational efficiency, increasing supply chain efficiency, and switching to using cleaner energy sources. Those corporate efficiency measures require the implementation of products, services, and technologies that are likely to enable avoided emissions. Those are the technologies, products, and services that will see an increase in demand, greater capital raising prospects, and greater growth prospects, becoming an attractive investment opportunity set for investors as we transition to a low-carbon economy. Government incentives are also helping to de-risk certain climate investment opportunities, making them more attractive to private capital.

The Adverse Effects and Consequences of Carbon

At the levels currently produced, carbon is resulting in warmer temperatures. This will likely trigger chain reactions of adverse effects on the weather, oceans, air, and our health. These will worsen with each passing year.

- **Ocean acidification** CO2 is absorbed by the oceans, leading to increased acidity. This can harm marine life, particularly organisms with calcium carbonate shells or skeletons, such as lobsters, shrimp, and other shellfish, as well as coral that provides the natural infrastructure that protects coastlines from storms and flooding in areas like Florida, Hawai'i, and parts of Texas.
- **Warmer temperatures** Excessive CO_2 and other gases trap heat energy in the Earth's atmosphere, causing warmer temperatures. Higher temperatures can make working outdoors more difficult for professions like construction workers, rig workers, livestock handlers, and fishermen. It makes it difficult to enjoy outdoor activities like summer camp, golfing, boating, hiking, cycling, and skiing. Higher temperatures also lead to increased frequency and intensity of storms, heatwaves, droughts, and floods, which raise insurance and rebuilding costs.
- **Air quality** Rising temperatures speed up chemical reactions in the atmosphere that create ozone. Ozone combines with other pollutants, pollen, and mold to create smog, which can worsen air quality. Smog worsens symptoms for people with existing heart or lung conditions like asthma and cardiovascular disease, causing a rise in healthcare needs and insurance premiums. It harms industries, such as tourism with decreased visibility leading to flight and cruise cancellations among other things.
- **Rising sea levels** Global warming melts polar ice caps and glaciers. This results in rising sea levels, leading to coastal erosion and more frequent and severe flooding. Coastal cities such as Miami, New Orleans, and Atlantic City, face significant threats to infrastructure, real estate, and overall habitability, causing economic and social disruptions.
- **Increased regulations** The U.K. announced a phase out of the sale of new gasoline and diesel cars and vans from 2030. Hybrid vehicles that can drive a significant distance with zero emissions will be allowed until 2035. U.S. automakers that sell into the U.K. will have to comply with this transition. The European Union adopted the EU Corporate Sustainability Reporting Directive that requires sustainability information to be reported even by non-European companies with significant European operations. The International Sustainability Standard Board climate-related and general sustainability standards were also adopted by the EU. In California, two new climate disclosure bills were adopted "to set mandatory and comprehensive risk disclosure requirements for public and private entities to ensure a sustainable, resilient and prosperous future for our state." The U.S. Securities and Exchange Commission (SEC) adopted rules that will require public companies to disclose climate change-related information in their SEC filings. While there is a temporary stay of the new SEC rules, international and subnational regulation of climate risk disclosure by both public and private companies is well underway.

To date, much of the literature on avoided emissions has focused on the perspective of companies, offering comparatively little guidance for the investors financing the products, technologies, and services that drive the transition to a low-carbon economy. This report addresses that gap by introducing avoided emissions from an investor's standpoint and outlining the steps to calculate this important metric. Along the way, it provides key questions to help investors critically assess the assumptions underlying these calculations. Additionally, it demonstrates how this metric complements investor decarbonization strategies and enhances informed investment decision-making.

The world produced approximately 60 gigatons of carbon and carbon equivalent emissions in 2022. The United States' emissions peaked at just below 6 gigatons of CO_2 in 2005. The U.S.'s near-term goal is to reduce emissions to 3 gigatons annually by 2030 with a longer-term goal to be carbon-neutral by 2050. New solutions that remove or avoid producing emissions are required to meet this goal.

1 Avoided Emissions

What Are Avoided Emissions?

Over the last ten years, several guidelines have emerged from organizations shaping the definition of avoided emissions. There is now broad consensus on the definition:

> **Avoided emissions are the expected emissions that a solution (a low-carbon product or service) prevents or saves with respect to a higher-carbon product or service it will replace in the market.**

Examples of products and services that avoid emissions include low-temperature detergents, fuel-saving tires, energy-efficient ball-bearings, fleet routing software, and teleconferencing services. Products and services that avoid emissions do so either by enabling emission reductions or by providing a low-emission version of existing products.

How Do Avoided Emissions Complement Emissions Reductions?

Investors want to know that their investment actions are addressing climate change, and they want to know the impact those actions are having. There are two ways investors measure their impact:

1. **Track reductions in their financed emissions.** The carbon footprint (scopes 1–3) of a portfolio company in which the investor has no financial or operational control, is reflected in the investor's financed emissions. Any year-over-year reduction in the carbon footprint of the portfolio company will flow through to the investor as a reduction in financed emissions. This is commonly referred to as *emissions reduction* or *decarbonization*. (See Figure 1.)

2. **Track emissions reductions enabled by their investments.** Two scenarios are described below.

   - An investor may have a portfolio company that is or has a low-carbon solution that will replace a higher-carbon source in the market that is serving the same or similar function as the solution. An example would be a portfolio company that manufacture's heat pumps that, when sold and installed, will replace energy produced from higher-carbon sources. The heat pumps will enable fewer emissions to be generated going forward. The emissions that will no longer be produced are called avoided emissions.

- An investor may provide capital or financing to transition a higher-carbon source to a low-carbon source. For example, an investor may provide the financing to a local school district to convert its school bus fleet from gas to electric or provide capital to fund innovation that reinvents industrial processes to be more energy efficient and generate emissions savings. The expected reduction in emissions due to the investor's financing of these projects is considered avoided emissions. (See Figure 2.)

Investors can finance emissions reductions, and they can reduce financed emissions. The impact of the former can be tracked with avoided emissions and the latter with annual changes in carbon accounting. Avoided emissions provide an additional piece of information that can help investors make decisions that support decarbonization.

Figure 1 · Hypothetical Emissions Footprint Reduction for Company XYZ

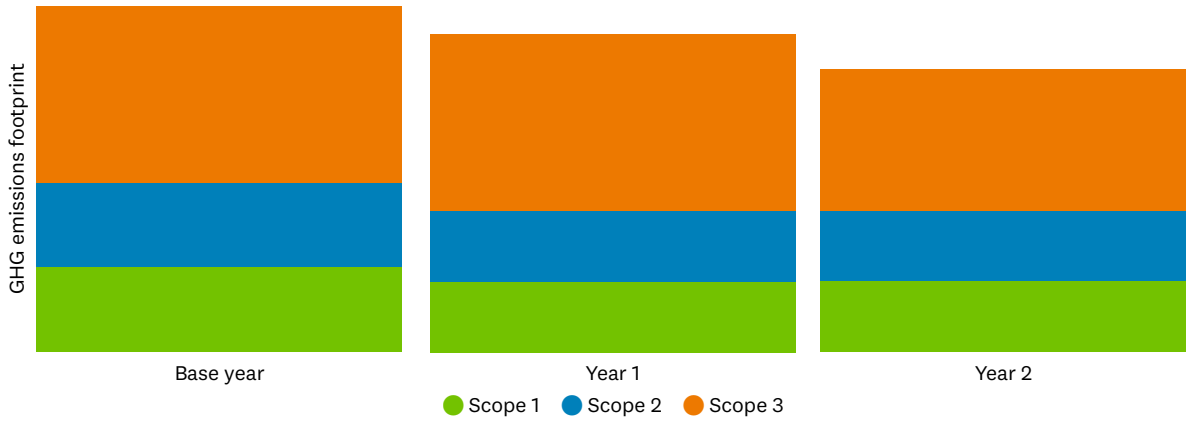
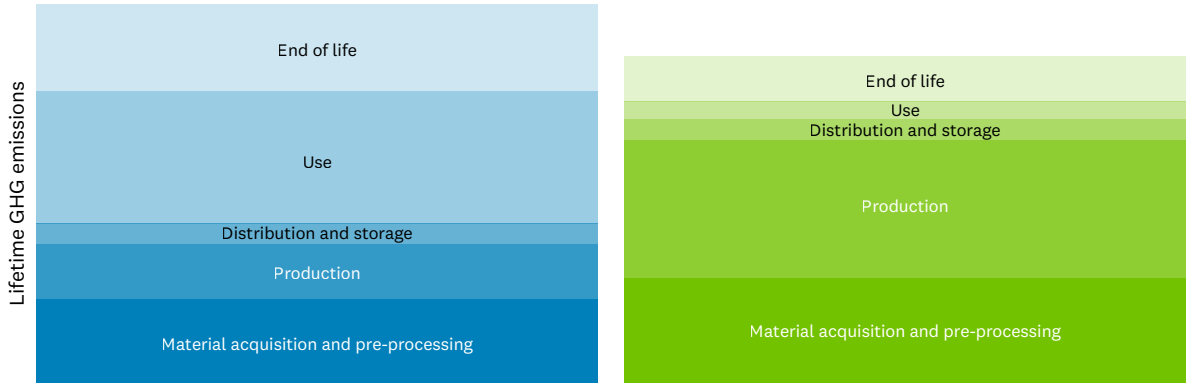


Figure 2 · Avoided Emissions Comparing Two Products



Adapted from WRI, Persefoni

Use of the Term "Scope 4"

The GHG Protocol defines scope 1 emissions as "direct emissions from owned or controlled sources" such as emission from fuel combustion in boilers, furnaces, and vehicles owned, scope 2 emissions as "indirect emissions from the generation of purchased energy" such as electricity, steam, heat, or cooling, and scope 3 emissions as all "indirect emissions, not included in scope 2, that occur in the value chain of the reporting company, including both upstream and downstream emissions." Together, scopes 1, 2, and 3 make up the emissions footprint of a company. This is carbon accounting.

Carbon accounting specifically concerns the total inventory of emissions produced by a company. However, it's important to note that avoided emissions are not included in this inventory. Avoided emissions refer to the variance between two sets of life cycle emissions: that of the solution and the reference scenario. Therefore, this report refrains from labeling avoided emissions as "scope 4" to prevent any confusion between avoided emissions and the emissions footprint of a company.

Why Investors Should Not Net or Cancel Out Their Portfolio's Emissions with Avoided Emissions

An investor may be tempted to optically reduce a portfolio's emissions (scopes 1, 2, and 3) by subtracting the portfolio's avoided emissions. While tempting, this should not be done and is not recommended by the leading carbon accounting bodies.

There are many reasons for this:

- **Optical reduction.** Using avoided emissions to mathematically offset the emissions footprint of a portfolio does not mean the emissions generated by the portfolio companies were, in fact, reduced. Offsetting would result in an optical reduction, not a real reduction in emissions.
- **Transition risk remains.** Using avoided emissions to optically offset emissions will not help a company in instances where a carbon tax is introduced, regulation changes, consumer behavior changes, or capital becomes harder to obtain because that portfolio company is still generating the same absolute level of emissions. The company would still be exposed to these risks.
- **Net zero will not be reached.** If companies continue to produce the same products and services without doing the hard work to decarbonize, the spigot of emissions remains open and flowing. Using avoided emissions to produce a visual reduction will not help achieve global net zero which requires reductions in absolute emissions produced.

How Do Avoided Emissions Add Value to Investors?

Calculating avoided emissions is not simple. As a result, avoided emissions is a metric not yet widely used by many investors. However, it is an important metric to help illuminate the degree to which a fund or company is contributing to the low-carbon transition, and one that is not fully captured by the commonly used metric of financed emissions. Some reasons investors have begun to use avoided emissions in their climate impact strategy include:

Identify investment opportunities. The use of avoided emissions can help identify investment opportunities by highlighting projects, products, and technologies that are in demand by companies seeking to decarbonize. Quite often, the remedies used by companies to reduce higher carbon emission sources entail projects that improve energy efficiency through better operational practices, lead to a switch to cleaner energy sources, or enhance carbon sequestration practices. These types of projects help to avoid the production of emissions that would otherwise have been produced. Businesses that enable emissions to be avoided should see increased demand as we transition to a lower-carbon economy, making them attractive due to their positive business prospects and significant carbon reduction potential.

Address misperception about the pathway investors are taking to reach net zero. Avoided emissions overcomes a failure in the current approaches that rely solely on tracking carbon footprints. For example, investment in new innovative clean energy solutions can cause the financed emissions of an investor to spike, making such an investment unattractive if only considered from an emissions reporting perspective. It will appear as if those investors are failing at their commitment to reduce portfolio emissions. However, this is not true. Those investors are investing in climate solutions and need a way to express the benefits of the investment. Avoided emissions is one such metric that can help complete the picture of the emissions path. Adding forward-looking avoided emission to the suite of information an investor considers can encourage investment in companies that are providing climate solutions.

Potentially improve a portfolio company's prospects and valuation. With the energy transition underway, investors seek to understand whether portfolio companies are future-proof businesses that can continue as viable concerns during and after the transition. Companies that are decarbonizing and contributing to avoiding emissions are better positioned in this regard. Such companies tend to attract funding and raise capital. A successful capital raise provides the portfolio company with many benefits such as funding for growth, debt repayment and future investments. It also increases the chances of accessing additional capital in the future and the potential to attract top talent with expertise which can help the company grow further. An investor's proactive stance to show how their portfolio company contributes to and will perform in the energy transition can enhance the company's long-term value, potentially leading to higher valuation multiples.

Provide more information for stakeholder engagement. Many investors and other financial institutions that are stakeholders via equity, debt, insurance, or other financial mechanisms seek to encourage their companies to increase the development and sales of low-carbon products and decrease the sales of their higher carbon products. For some, avoided emissions serve as a metric they can use in these stakeholder engagement activities to quantify the potential climate impact of these recommendations.

How Can Avoided Emissions Be Misused?

Transparent and conservative calculations of avoided emissions can add value for investors. However, as with any forward-looking estimate, there is potential for avoided emissions to be misused. (Of course, a good faith estimate of avoided emissions may still be wrong due to unanticipated events, such as an unforeseen spike in interest rates or inflation that can depress the renewables markets, etc.). Ways that avoided emissions could be misused include:

- Investors may inflate or promote misleading avoided emissions estimates to attract funding or satisfy regulations without delivering real results.
- Investors may invest in companies or projects that claim to have the potential to avoid emissions without verifying the actual impact or ensuring that the reductions are permanent and significant.
- Investors may calculate and promote the avoided emissions of an investment without disclosing whether the investment leads to unintended negative environmental consequences in other areas. These negative shifts could be on other impact categories (such as water, waste, and social consequences) or shift emissions elsewhere such as outside of the scope of emissions of the solution.
- Investors may disclose only the avoided emissions of their investments, without disclosing the actual emissions footprint of the investments, thus failing to show the current actual impact the investment has on the environment.
- Investors may promote avoided emissions for certain investments while continuing or increasing investments in higher carbon investments elsewhere, leading to a net increase in GHG emissions overall.

To mitigate the risk of misuse, investors should follow guiding principles such as the GHG Protocol accounting and reporting principles of relevance, accuracy, completeness, consistency, and transparency and the European Commission's March 2024 Directive on Green Claims. The G7 countries have stated that "claims on the environmental performance of various entities should be reliable, comparable and verifiable to empower consumers, companies and investors to accelerate efficient emission reductions and reduce the risk of inappropriate use." Using avoided emissions to grossly misconstrue actual environmental impact and mislead investors may be deemed by the SEC to be fraudulent. All investment advisors, whether registered with the SEC or not, are subject to the SEC's anti-fraud provisions that prohibit misstatements or misleading omissions of material facts and other fraudulent acts and practices in connection with the conduct of an investment advisory business.

2 Methodology to Calculate Avoided Emissions

Avoided emissions find their roots in The Greenhouse Gas Protocol for Project Accounting, first published in 2006 by WBCSD and the WRI. While avoided emissions were not mentioned by name, the Project Accounting Standard provided specific principles, concepts, and methods for quantifying the greenhouse gas benefits of climate change mitigation projects. In 2013, WBCSD contributed to developing the concept in an industrial setting by publishing a guideline for accounting and reporting of chemical products. As companies started making avoided emissions claims, WRI published a working paper scrutinizing existing practices to enhance the credibility and consistency of such claims. Recent reports have included the publication of an end-to-end framework for the calculation of avoided emissions by Mission Innovation and the 2023 WBCSD Guidance on Avoidance Emissions which provides guidance around the eligibility of a company to make avoided emissions claims and best practices around reporting to mitigate the risk of greenwashing claims.

See Appendix B for a review of the key framework methodology landscape, including core contributions from each of the methodologies.

Calculating Avoided Emissions

Not all investors will want or need to perform a detailed calculation of avoided emissions. For example, if an investor simply wants only a rough estimate that will not be published, then that investor need not worry about attribution. On the other hand, if an investor intends to publicly report the avoided emissions numbers or make claims about their investments based on the avoided emissions number, they will need to take more care in the calculations, and what is disclosed will be very important. Such considerations prompted the European Commission's Directive on Green Claims.

For investors who want to perform a detailed calculation of avoided emissions, there can be some confusion about how to do the calculation. However, the frameworks examined for this report all follow the same calculation approach, which is to:

> **Use emission factors to compare the life cycle emissions for a solution against the life cycle emissions of an average reference scenario and provide qualitative disclosure of material rebound effects.**

Across all the frameworks, there are five general steps to calculating avoided emissions.

- Step 1: Identify the solution
- Step 2: Select the reference scenario
- Step 3: Estimate the emissions
- Step 4: Calculate the avoided emissions
- Step 5: Attribution approach

For investors who receive avoided emissions numbers from portfolio companies and would like to better understand the assumptions behind the numbers, each step includes an Investor Toolkit with questions to ask. Since access to granular company data varies by investor type, these steps also include considerations by investor type.

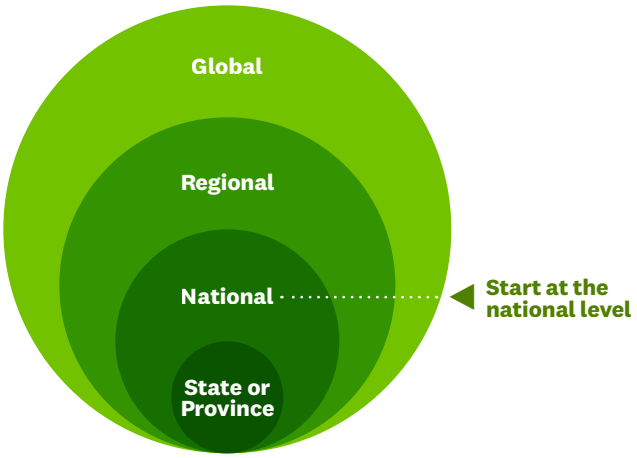
Step 1 · Identify the Solution

The process begins by describing what the solution is and defining the purpose of the solution and how the output of the solution is measured. For example, the solution may be an energy efficient light bulb that replaces higher energy consuming bulbs. The purpose of the energy efficient bulb is to improve the energy efficiency of lighting. The output is measured in kilowatt-hours of electricity.

It is important to not only describe the solution but also identify where the solution will be deployed, (whether a specific region, nationally, or on a global scale). Knowing the geographic region for where the solution will be deployed will assist in selecting the reference case against which the solution will be compared. For example, the reference case for a solution deployed in Africa will be different from the reference case for that same solution if it were deployed only in California.

However, in some cases it is difficult to forecast where the solution will eventually be deployed. The GHG Protocol and the Net Zero Initiative suggest it makes sense to start with national (country level) boundaries to define the geographic area, and to modify this area as clarity is obtained.

Figure 3 · Defining the Geographic Area



Adapted from The GHG Protocol Project Accounting

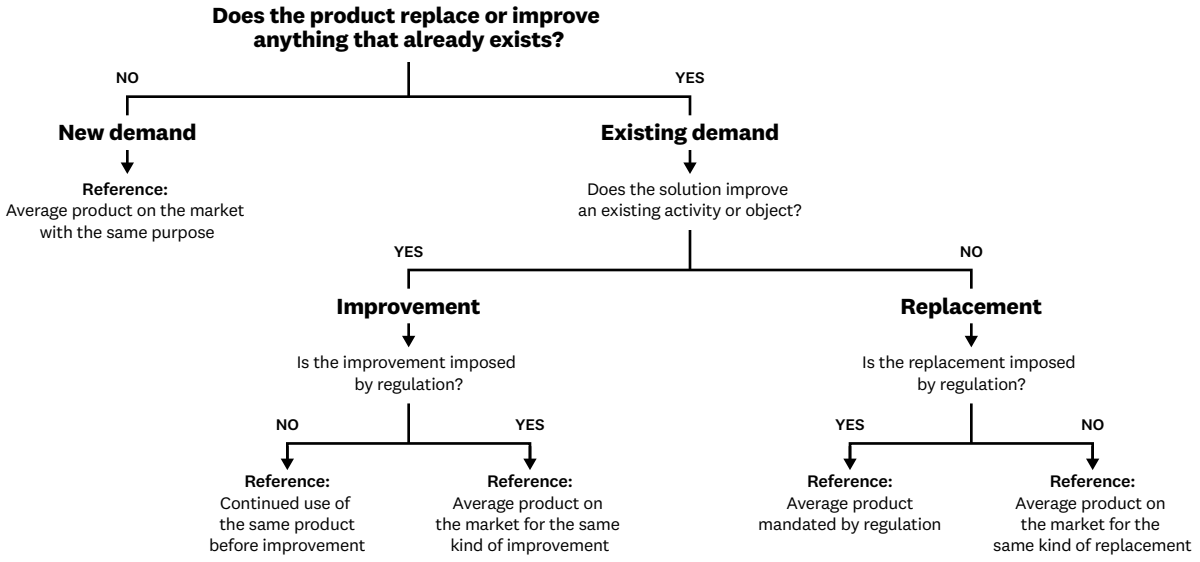
Investor Toolkit: Identify the Solution

- Which product or service in the portfolio company is identified as an emissions solution?
- What percentage of revenues does that product or service represent for the company?
- What purpose does the product serve?
- What is the expected output of the solution?
- How is that output measured?
- In what regions or geographies is the product deployed or expected to be deployed?
- Is the solution also defined as a climate solution through sustainable finance taxonomies, such as the EU taxonomy?

Step 2 · Select the Reference Scenario

The credibility of an avoided emissions calculation depends on the reference scenario, which must reflect as best as possible the situation that would have occurred without the solution. The choice of reference scenario will be limited to the existing products or services in the geographic area where the solution is deployed. As noted previously, the reference case for a solution deployed in Africa will be different from the reference case for that same solution if it were deployed only in California.

Figure 4 · Determining Which Avoided Emissions Assessment to Use



Adapted from WBCSD Guidance on Avoided Emissions

As seen from the decision tree, depending on the context in which the solution will be implemented, the reference case will be either a "specific product or service" or the "average product or service" in the market where the solution will be deployed.

- **Specific product or service** This reference case is used in scenarios where the solution keeps the existing product and enables it to produce lower emissions. While the GHG Protocol Project Standard provides guidelines for selecting a project-specific reference candidate, the WBCSD narrows the use of a project-specific candidate to scenarios where (1) the existing product or service will continue in use but with the solution enabling it to improve emissions or (2) the existing product or service will continue in use until its end of life and only at the end of its life, will it then be replaced by the solution.

  For example, if the solution is energy efficiency software that reduces the energy use of a household appliance, the reference case should be the use of that appliance without the efficiency boost brought by using the software.

- **Average product or service** This reference case is used when the solution's function can be performed by multiple existing products. In this case, the average existing product or service is often selected as the reference case. This is similar to the GHG Protocol's Performance Standard Benchmark in the Project Accounting Standard. This can be best explained with a couple of examples.

  In the case of heat pumps (the solution), the reference case would be the "average heating solution" in the market, which would include gas boilers, wood burnings stoves, forced air systems, etc.

  In the case of an electric vehicle (the solution), the reference case would be "the average vehicle" out on the road, which would include a mix of electric, gasoline, hybrid, and diesel vehicles. A common error is to use just the most common technology (an internal combustion vehicle with poor fuel economy) as the reference case.

It's important to reiterate that the legitimacy of an avoided emissions calculation rests on the reference case chosen. For investors who are calculating avoided emissions for a portfolio company that it considers to be a climate solution, the investor should take care not to select a reference case that will lead to an overestimate of the avoided emissions of the solution. If in doubt, the more conservative reference case with the lower emissions profile should be selected.

Investor Toolkit: Reference Case

- Which reference case has been used (average, specific, other) and why?
- Is it a regional, national, or global reference case and does it align with the geography of the solution?

Step 3 · Estimate the Emissions

This step requires estimating the full life cycle emissions of the solution and the reference case. The GHG Product Life Cycle Standard provides detailed guidance on conducting a life cycle assessment.

To estimate the emissions at each phase of the life cycle, the investor needs activity data and corresponding emission factors. Direct measurement of emissions is the best data, but investors are

not likely to have the ability to directly measure emissions, making it necessary to estimate emissions with activity data and emission factors.

- Activity data is based off a functional unit which is a quantifiable unit on which to measure a product's emissions footprint.
- Emission factors are GHG emissions per unit of activity data.

Figure 5 • Examples of Activity Data and Corresponding Emission Factors

Activity data	Emission factor
Liters of fuel consumed	Kilograms of CO_2 emitted per liter of fuel consumed
Kilowatt-hours of electricity consumed	Kilograms of CO_2 emitted per kWh of electricity consumed
Kilograms of material consumed	Kilograms of PFC emitted per kilogram of material consumed
Kilometers of distance traveled	Tons of CO_2 emitted per kilometer traveled
Hours of time operated	Kilograms of SF_6 emitted per hour of time operated
Square meters of area occupied	Grams of N_2O emitted per square meter of area
Kilograms of waste generated	Grams of CH_4 emitted per kilogram of waste generated
Kilograms of product sold	Kilograms of HFC emitted per kilogram of product sold
Quantity of money spent	Kilograms of CO_2 emitted per unit of currency spent

Adapted from The GHG Protocol Scope 3 Standard

To estimate emissions, an emissions factor is multiplied by the corresponding activity data:

activity data × emissions factor = GHG emissions

Activity data can be obtained from:

- Company reports
- Proxy estimates by taking the average activity data of products in the market. The GHG Protocol Project Standard provides guidance on selecting proxies. The Net Zero Initiative's *The Pillar B Guide* refers to this as the "Market Average Approach."

Emission factors should be obtained from credible sources such as:

- The EPA GHG Emission Factors Hub
- The GHG Protocol Calculation Tools and Guidance
- U.S. EPA's Environmentally Extended Input–Output (EEIO) database

The activity data should be based on a functional unit that is relevant to the end-use of the solution. For example, it would be appropriate to measure the emissions of a wind turbine based on kilowatt-hour of electricity generated given that providing energy is the end-use function of the wind

turbine. It would not be advised to measure the wind turbine emissions based on the square meters of area occupied by the turbine.

In order to have an apples-to-apples comparison, the functional unit on which the activity data is based, must be the same for the solution and the reference case.

Investor Toolkit: Estimate the Emissions

- What stage of the solution's life cycle do the emission factors consider (including production, use, and disposal)?
- Are the assessed and reference products compared using the same functional unit to ensure a like-for-like comparison?
- Does the data used for the assessed and reference products consider geography, technology and time (i.e., how current is the data)?
- Does the company include all significant positive and negative impacts in the assessment, wherever they occur and whenever they can be assessed using reliable and verifiable data?
- Are there any discrepancies between the nature of the climate solution and the emission factor selected (such as using an EV emission factor for a hybrid car)?

Considerations by type of investor for Step 3

Investors in listed equity/corporate fixed income and limited partners of private equity/debt firms are usually removed from detailed company emissions data. As a result, they may rely more heavily on public company comments on avoided emissions and ask questions using the Investor Toolkit to better understand what choices were made by the company to derive the avoided emissions number. General partners of private equity/debt funds tend to have access to actual, granular, company data, so are more likely to perform an LCA with first-party primary data. For investors in emerging climate products and technologies that are still in development and not yet in production, such as venture capital (early-stage) investors, they may consider using a proxy technology or proxy product to derive an emissions factor to start, then as the product matures and moves from development to operation, the emissions factor can be updated with actual data.

Step 4 · Calculate Avoided Emission

Avoided emissions factor

The avoided emissions factor is how much emissions would no longer be produced when one unit of activity data of the higher-carbon product or service is replaced by one unit of the same activity data of the lower-carbon product or service. This is also referred to as the "avoidance factor" by the Net Zero Initiative and "carbon abatement factor" by Mission Innovation.

To obtain the avoided emissions factor of the solution, subtract the solution's emissions factor from the reference case's emissions factor:

emissions factor for reference case – emissions factor for solution = avoided emissions factor

Figure 6 • Avoided Emissions Factor for an Electric Vehicle

	Units	2023
Emissions factor (cradle-to-grave) — market average car	kg CO_2e/km	0.25
Emissions factor (cradle-to-grave) — electric vehicle	kg CO_2e/km	0.03
Avoided emissions factor (cradle-to-grave)	kg CO_2e/km	0.22

Based on hypothetical data; the functional unit is km driven

Backward-looking avoided emissions

To estimate avoided emissions that are enabled by units of the solution that were sold in the prior reporting year, multiply the avoided emissions factor by the climate solution's prior year actual sales or user data, which would be the actual number of products or services sold, or the number of active users for a specific service or technology platform. Backward-looking avoided emissions are often used for reporting purposes by a company because the time period is consistent with a company's reporting of financial data.

Figure 7 • Example of Backward-Looking Avoided Emissions for an Electric Vehicle

	Units	2023
Emissions factor (cradle-to-grave) — market average car	kg CO_2e/km	0.25
Emissions factor (cradle-to-grave) — electric vehicle	kg CO_2e/km	0.03
Avoided emissions factor (cradle-to-grave)	kg CO_2e/km	0.22
Number of vehicles sold	#	13,000
Average distance driven (Country A)	km	10,000
Avoided emissions	**tCO_2e**	**27,880**

Based on hypothetical data; numbers may not add up due to rounding

Forward-looking avoided emissions

When performing investment analysis, it is common to model out the financial statements and financial return potential of an investment. Likewise, an investor may want to model the avoided emissions that would be enabled by future sales of the solution. Given the future is not static and the world is always changing, the calculation of forward-looking avoided emissions involves using dynamic inputs: dynamic emission factors and dynamic sales or user volumes.

1: Forward emission factors

Keeping emission factors constant may be appropriate for short-term forecasts but not for long-term ones because the world and technologies are constantly changing. For example, as more climate solutions are implemented, fewer emissions will be generated in the outer years.

All the frameworks reviewed recommend dynamic emission factors. Some investors align future emission factors with a climate scenario. Climate scenarios are projections of future GHG emissions created using economic and climate models. These include estimates of economic activity, policy, and technological change and are useful for making projections about emission factors. Among the most widely used scenarios are those from NGFS, IPR, and IPCC.

Investor Toolkit: Forward Emission Factors

- Are the emission factors static or dynamic?
- How are dynamic emission factors forecasted (i.e., what climate scenario, if any, is used?)
- How often do you reevaluate the numbers and sensitize them to the current market conditions?

Case Study: Dynamic Emission Factors in the Lombard Odier Approach

Lombard Odier created the Global Climate Bond Fund to invest in clean energy, water, and emissions reduction projects, supporting the transition to a cleaner, more sustainable economy and delivering measurable environmental benefits. In 2022, Lombard Odier reported project-level net zero alignment and avoided emissions from its sustainable investments using a methodology developed in-house.

In its approach, Lombard Odier uses dynamic emission factors to determine the avoided emissions factor for its climate solutions. As an example of their methodology, Lombard Odier presents the avoided emissions enabled by a wind farm, calculating them against the average grid emission factor as the reference case.

In its 2022 Impact report, Lombard Odier discusses dynamic emission factors as an advancement against the methodology used in previous years. Previous efforts considered a static emission factor over the investment's lifetime. The updated 2022 methodology aligned the reference case emission factor with the IEA STEPS climate scenario (a "current policy" climate scenario). The result was that the reference case's grid emission factor became less carbon intensive over the forecast period in line with current and announced global policies, resulting in a more conservative estimate when compared to a calculation relying on a static emission factor.

2: Forward sales or volume

Sales and volume forecasts for the out years may be obtained from the company or any credible financial data source such as Bloomberg or FactSet. Investors may choose to create their own detailed financial statements model with their own assumptions for future deployment of the solution informing future sales. Prime Coalition's Project Frame describes two forward-looking impact

approaches, potential and planned impact, that differ in how the calculations account for future deployment of the solution.

- **Potential Impact** The impact a proposed climate solution could have based on a standardized growth trajectory that assumes the proposed solution takes over the Serviceable Obtainable Market.
- **Planned Impact** The impact expected from a company or a proposed climate solution based on a realistic analysis of its business model.

Transparency of all assumptions, including those used for future sales, is important to reduce the risk of the investor being accused of greenwashing.

Investor Toolkit: Forward Sales or Volume

- What is the expected lifetime or number of uses of sold products used in the forward estimates?
- What macro-economic assumptions went into the sales and volume numbers?
- What company specific/product specific assumptions went into the sales and volume numbers?
- What competitive advantages does the solution have that lead to these assumptions?

3: Forward time frame

In investment analysis, investors often model financial metrics out for a number of years, including one year, five years, 10 years or, in the case of discounted cash flow analyses, an indefinite time in the future. When modeling forward-looking avoided emissions, some investors elect to look out as far as certain target milestone dates such as 2030, 2040, or 2050. Some investors prefer not to look beyond a ten-year time frame, believing there is a "time value of carbon" and emissions avoided in the nearer term are more valuable than emissions avoided too far out into the future. The GHG Protocol Project Accounting Standard notes that "generally, the farther out into the future one tries to project 'what would have happened,' the more uncertain this projection becomes." Whatever time frame is chosen should be disclosed for transparency.

Investor Toolkit: Forward Time Frame

- What is the time frame used for the avoided emissions calculation?
- Why was that time frame selected?

4: Calculate forward-looking avoided emissions

This forward-looking calculation involves scaling the avoided emissions calculated at the unit level (such as for one product, one user, or a service unit) to the total sales and volume of the climate solution that has been sold or is expected to be developed.

Having modeled out the emission factors for the solution and the reference scenario, the avoided emissions factor for each year can be calculated. From there, the avoided emissions factor for each year is multiplied by the corresponding year's sales and volume number. These annual avoided emission numbers can then be aggregated to determine the cumulative emissions avoided over a time horizon. See Figure 8 below for an illustrative example.

Investor Toolkit: Calculate Avoided Emissions

- Is the calculation forward-looking or backward-looking?
- Is the calculation for a single year or cumulative?
- If the calculation is cumulative, do you consider changes in the reference case over the time frame?
- How often will the calculation be performed to understand progress achieved against projections?
- Has the calculation included any degree of uncertainty, discounting, or sensitivity analysis?
- What are the potential risks or challenges associated with sustaining these avoided emissions over time?
- Has the calculation methodology changed from last year? How and why?
- Has the calculation and results been audited or verified?

Considerations by type of investor for Step 4:

Investors can model out sales and volume information for the solution based on company guidance and/or proprietary estimates or, if available, they can use market forecasts for the company found on Bloomberg, FactSet, or any formal source of financial forecasts.

Figure 8 · Example of Forward-Looking Avoided Emissions for an Electric Vehicle

	Units	2025E	2026E	2027E	2028E	2029E	2030E
Emissions factor (cradle-to-grave) — market average car	kg CO_2e/km	0.25	0.24	0.24	0.24	0.23	0.23
Emissions factor (cradle-to-grave) — electric vehicle	kg CO_2e/km	0.03	0.03	0.03	0.02	0.02	0.02
Avoided emissions factor (cradle-to-grave)	kg CO_2e/km	0.22	0.22	0.22	0.22	0.21	0.21
Number of vehicles to be sold	#	15,000	20,000	25,000	30,000	35,000	40,000
Average distance driven (Country A)	km	10,000	10,000	10,000	10,000	10,000	10,000
Avoided emissions	**tCO_2e**	**33,000**	**43,000**	**53,750**	**66,000**	**74,200**	**85,600**

Based on hypothetical data; numbers may not add up due to rounding

Step 5 · Attribution Approach

Attribution is the process of allocating the positive GHG impact to various participants based on the relative contributions of each participant.

Attribution can occur among capital providers (vertically) and across the supply chain (horizontally). These are discussed in detail below.

In practice, many investors do not perform an attribution to 'take credit' for the avoided emissions produced by their portfolio companies. Instead, they opt to disclose the total avoided emissions of the portfolio company and simultaneously disclose their percentage ownership in the company. Part of the reason for the lack of attribution is the difficulty in determining who can enlist to be assigned a portion of the GHG impact and how the assignments will be made.

Vertical attribution

Vertical attribution assigns a portion of the avoided emissions of the portfolio company to its capital providers. In practice, investors using the vertical approach tend to follow the Partnership for Carbon Accounting Financials (PCAF) Standard for attribution of GHG emissions for the lending and investment activities of financial institutions.

- For listed companies the PCAF Standard is: outstanding amount at stake divided by enterprise value including cash (EVIC)
- For private companies the PCAF Standard is: outstanding amount at stake divided by total equity + total debt

PCAF's total funding attribution method (including debt) reduces double counting while crediting debt investors for their role in a company's growth.

Instead of following the PCAF method for attribution, some investors, especially listed equity holders, use their equity ownership as a percentage of the company's total market value to assign attribution. The benefits of this approach are that it's easy to apply and is the common method used by listed equity investors when reporting their ownership stake in a company. The negatives are that

it does not consider the total capital, including debt holders, of the company and therefore potentially overestimates the equity holder's share of avoided emissions attributed to it.

Investor Toolkit: Vertical Attribution

- What percentage stake does the investor have in the solution?
- Was the PCAF method for attribution used? If not, why? Which method was used?

Horizontal attribution

Horizontal attribution is the process of assigning portions of a solution's avoided emissions to contributors along the solution's supply chain. In theory, horizontal attribution is helpful in reducing double counting of avoided emissions for a given solution by value chain stakeholders. For example, an investor investing in or financing a component supplier to a solution would double-count avoided emissions if that investor also invested in or financed another component supplier of that same solution and decided to calculate the avoided emissions of both suppliers.

However, the reality of doing horizontal attribution accurately for a solution (that could have hundreds of supplier companies) may not be realistic. The process can quickly become complicated due to changes in the capital structure of the supplier, independent of changes in the investor's ownership stake. In addition, each investor estimating the horizontal attribution for each solution held in portfolios (rather than each company disclosing what their attribution should be) could lead to inconsistent outcomes between investors. It's important to recognize that the process requires assumptions which will not be constant over time and that could differ significantly by investor depending on the underlying assumptions used. For these reasons, many investors opt to not do any attribution and simply disclose 100% of the avoided emissions of a solution together with their own percentage ownership in the supplier to the solution, with clear transparency that as an investor, they are reporting the supplier's impact and not trying to calculate their own. Further, if the investor holds both the solution company and its suppliers in the portfolio and calculated the avoided emissions based on the same solution, then the investor should disclose this nuance and not add the avoided emissions together.

Below we describe a two-step process for determining avoided emissions by an investor in a component supplier to a solution in a horizontal attribution scenario:

- **Step 1: Determine what percent of the solution's avoided emissions should be assigned to the supplier** The Net Zero Initiative's The Pillar B Guide recommends that horizontal attribution across suppliers be done such that there is consistency between the avoided emissions of the final product (the solution) and the induced emissions of the final product (the solution) that each supplier reports. This indicates that each supplier must declare, in its own inventory accounting, a portion of the induced emissions generated by the solution and not just show the emissions avoided by the solution.

  To determine what that percentage is, the GHG Protocol Scope 3 Standard recommends using

a physical proportion and if physical data is not available, then use an economic proportion. For a list of physical and economic allocation formulas, see the GHG Protocol Scope 3 Standard.

In one hypothetical example from the Net Zero Initiative-The Pillar B Guide, Alpha is a company that produces car seats only for electric vehicles produced by company Beta. As a supplier, Alpha wishes to claim a share of avoided emissions generated by the EVs that it equips. Alpha's car seat accounts for 1% of the total physical weight of an EV produced by Beta. Therefore, Alpha declares 1% of the induced emissions of the EV in the reporting of its own carbon footprint. Alpha may also attribute to itself, the avoided emissions enabled by the EV at that same proportion of 1%.

- **Step 2: Multiply the supplier's exposure percentage by the investor's percentage stake (equity and debt investment) in the supplier** An investor would attribute a portion of the avoided emissions claimed by the supplier, based on the investor's percentage ownership of the supplier. Here the investor would follow the PCAF standard for attribution of GHG emissions, same as described above in the vertical attribution section.

Investor Toolkit: Horizontal Attribution

- Is the climate solution a component to a final product or is it the final product itself?
- If there has been horizontal attribution, how were the percentages assigned?

Considerations by type of investor for Step 5:

The PCAF standard for attribution of emissions has been the preferred method by many types of investors that decide to attribute avoided emissions.

Illustrative Example: Calculating the Avoided Emissions of an Electric Vehicle Battery

In this illustrative example, based on hypothetical emissions and production data, we focus on a simplified forward-looking calculation of avoided emissions of investing in a company that creates a long-range battery for use in an electric vehicle in a single country.

The calculation starts by defining the solution and a relevant, conservative reference case then obtaining their emissions factors.

Solution: Electric Vehicle Sold in Country A that Replaces Existing Vehicles

Vehicle type	Cradle-to-grave emissions factor
EV	0.03

Reference Case: The Existing Mix of Vehicles Used in Country A

Vehicle type	Cradle-to-grave emissions factor	Total cars sold (millions)	Percent of car mix	Weighted emissions factor
Gas	0.24	19	58%	0.14
Diesel	0.30	11	35%	0.10
Hybrid/EV	0.08	2	7%	0.01
Market average car				**0.25**

Based on hypothetical data

This is a hypothetical example using cradle-to-grave emissions factors. If cradle-to-grave emissions factors cannot be found, the GHG Protocol recommends filling the missing phases with proxy data. Any limitations to the data (such as the use of proxy data for missing phases) needs to be disclosed.

The emissions factors are made dynamic to match expected climate policy scenarios and technological advancements over time, with both the reference case factor expected to decrease due to increases in fuel efficiency, and the emission factor of the electric vehicle expected to decrease due to decarbonization of the electric grid.

The avoided emissions factor (the difference between these two separate emissions factors) is then calculated across each year. By multiplying the hypothetical number of electric vehicles that will replace the market average vehicle sold in a given year by the projected annual kilometers each car drives, and the avoided emissions factor, avoided emissions can be calculated each year.

Once the total avoided emissions are calculated, a horizontal attribution is made to distribute them across the value chain. In this illustrative example, 50% is attributed to the supplier (the electric car battery producer), while the remaining 50% is assigned to other participants in the value chain.

Continues ▶

Illustrative Example (continued): Calculating the Avoided Emissions of an Electric Vehicle Battery

Finally, we assume the investor owns 10% of the shares outstanding of the battery supplier. A vertical attribution is done based on the investor's proportional contribution to the market cap of the battery supplier equal to 10%.

Figure 9 • Example of Avoided Emissions Attribution for an Investor with a 10% Interest in an EV Battery Supplier that Accounts for Half of the EV's Induced Emissions

	Units	2025E	2026E	2027E	2028E	2029E	2030E
Emissions factor (cradle-to-grave) — market average car	kg CO_2e/km	0.25	0.24	0.24	0.24	0.23	0.23
Emissions factor (cradle-to-grave) — electric vehicle	kg CO_2e/km	0.03	0.03	0.03	0.02	0.02	0.02
Avoided emissions factor (cradle-to-grave)	kg CO_2e/km	0.22	0.22	0.22	0.22	0.21	0.21
Number of vehicles to be sold	#	15,000	20,000	25,000	30,000	35,000	40,000
Average distance driven (Country A)	km	10,000	10,000	10,000	10,000	10,000	10,000
Avoided emissions	**tCO_2e**	**33,000**	**43,000**	**53,750**	**66,000**	**74,200**	**85,600**
Horizontal attribution	%	50%	50%	50%	50%	50%	50%
Vertical attribution	%	10%	10%	10%	10%	10%	10%
Avoided emissions attributed	**tCO_2e**	**1,650**	**2,150**	**2,688**	**3,300**	**3,710**	**4,280**

Based on hypothetical data; numbers may not add up due to rounding

Investors can use avoided emissions enabled by a solution (both the backward-looking and the forward-looking avoided emissions) to better understand the total impact the solution can have on global emissions. This does not replace, but instead complements, the year-over-year emissions reductions of embodied emissions taking place in the investor's portfolio companies. The avoided emissions metric is another tool in the investment analysis process that can help inform investment decisions that lead towards decarbonization.

GHG Protocol Product Life Cycle Reporting Standard

The GHG Protocol Product Life Cycle Standard provides requirements and guidance for companies and stakeholders that choose to perform product comparisons, as is done when determining avoided emissions. It recommends following specifications:

1. The unit of analysis should be identical.
2. The system boundaries and temporal boundary should be equivalent.
3. The same allocation methods should be used for similar processes.
4. The data types used and the data quality and uncertainty of data should be reported and assessed to determine if a fair comparison can be made.
5. The temporal and geographical representativeness of the inventories should be assessed to determine if a fair comparison can be made.
6. Third party assurance should be performed.

3 Suggested Disclosure Guidance

Best practice in reporting is to:

- Disclose avoided emissions separate from GHG inventory footprints (scope 1–3 emissions)
- Do not use avoided emissions to claim carbon neutrality or emission reductions

Assessments of avoided emissions are increasingly being conducted by investors, but every calculation is informed by the assumptions an investor makes. Pushback on assessments by skeptics of avoided emissions often stems from lack of data, lack of transparency, and concerns about comparability. In the absence of a formal reporting standard for avoided emissions, transparency is crucial for establishing credibility. Proper disclosure will minimize misinterpretation and help reduce concerns about greenwashing.

Best practice should include the following methodological assumptions and choices used in calculations:

- **Emissions scope:** Disclose the scope of emission factors used in the calculation (for example, cradle-to-grave life cycle emissions or only use phase emissions) and justify instances in which these do not cover the full life cycle of a product or service.
- **Reference case choice:** State the chosen reference scenario and justify it with empirical evidence and plausible assumptions.
- **Data constraints:** Disclose any data availability issues concerning sectors, geographies, scenarios, timelines, and emerging climate technologies that contribute to dynamic, climate scenario-aligned, and granular data for both emission factors and technology mixes.
- **Technological evolution:** State whether any adjustments have been incorporated into either the solution or reference case emission factors when forecasting them. This should include their source, and a determination of their adherence to a climate scenario in case of a third-party forecast or the assumptions used in case of an in-house forecast.
- **Rebound effects:** Qualitatively identify possible rebound effects
- **Disclosure:** Disclose the share of the total company's revenues that pertain to the solutions generating avoided emissions.
- **Assurance:** If avoided emissions calculations have been validated or audited, disclose when and by whom.

A Note on Climate Disclosures

In the last decade, considerations related to the impact of climate change have become mainstream throughout financial markets. Investors have redefined their standards in relation to climate-related efforts in response to changes in investment preferences and because of increased regulatory scrutiny over the climate contributions of their portfolios.

The frameworks guiding financial institutions on annual disclosures of their climate risk and opportunities have included TCFD, ISSB sustainability reporting standards, the Transition Plan Taskforce, and GFANZ's CTAP.

As of October 2023, the TCFD has been disbanded due to fulfilling its remit; its progress monitoring responsibilities have been assigned to the IFRS Foundation. The ISSB aims to create a comprehensive set of global sustainability reporting standards, covering a wide range of ESG factors beyond climate, by building upon the four reporting pillars established by TCFD. Building on the guidance provided by TCFD on climate-specific disclosures and ISSB on unified sustainability reporting standards, The TPT and GFANZ provided frameworks to create CTAPs which assess carbon management and transition strategies in the context of climate change mitigation.

The GFANZ financial transition plan standard provides an industry guideline with broad recommendations on how to set up strategic roadmaps to outline commitments and actions to achieve net zero GHG emissions. GFANZ identifies four financing strategies to drive the transition:

1. Financing or enabling entities and activities that develop and scale climate solutions
2. Financing or enabling entities that are 1.5°C aligned
3. Financing or enabling entities that are committed to transitioning in line with 1.5°C aligned pathways
4. Financing or enabling entities the accelerated managed phaseout of high emitting physical assets

The TPT is a government initiative working closely with GFANZ, ISSB, and TCFD to incorporate and standardize their approaches in a strategic and rounded approach to disclose a company's ambition, planned actions and governance towards net zero. The effort resulted in the development of a gold standard for organizations in developing a trustworthy and resilient climate transition strategies which aims to address the variance in detail and quality of existing disclosures.

CDP as part of its "CDP Climate Change 2023 Questionnaire" asks questions on avoided emissions related to "low-carbon products." All the 2023 responses have been published but CDP has not analyzed or published insights on the responses.

4 Common Questions

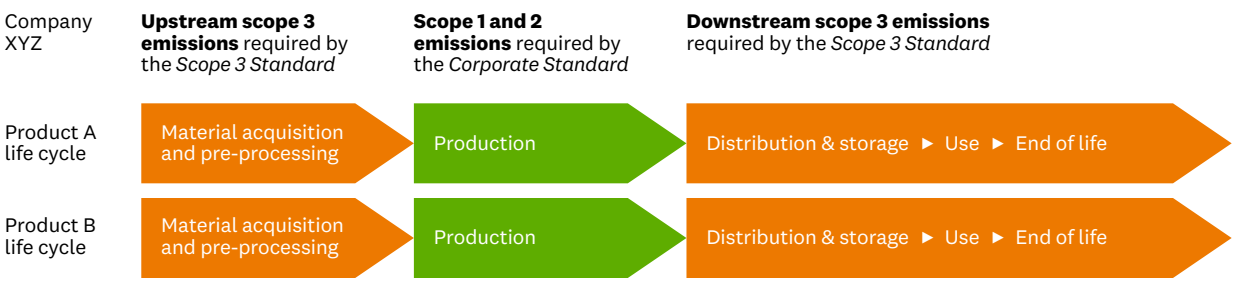
Can Avoided Emissions Assist with Scope 3 Data Gathering?

Information used to calculate avoided emissions may be useful when calculating scope 3. Avoided emissions are the comparison of emissions from two separate life cycle assessments (LCAs), the solution, and the reference case. All life cycle assessments are performed at the product level, not the company (or entity) level. As noted previously, an LCA includes all phases of life of a product, including raw material acquisition, transportation/distribution, use and end-of-life. These correspond to various categories within scope 3 on the company level. The sum of the life cycle emissions of each of a company's products, combined with additional scope 3 categories (such as employee commuting, business travel, and investments), should approximate the company's total corporate GHG emissions (scope 1 + scope 2 + scope 3) according to The GHG Protocol Product Life Cycle Standard.

In practice, companies are not expected or required to calculate life cycle inventories for individual products when calculating scope 3 emissions. However, if a company has performed LCAs for their products to use in avoided emissions calculations, then they are a great deal closer to gathering their scope 3 emissions.

The illustration below shows how scopes of emissions at the corporate level correspond to life cycle stages at the product level.

Figure 10 · Product-Level Scopes of Emissions vs. Life Cycle Stages



Adapted from The GHG Protocol Scope 3 Standard

Are Avoided Emissions Backward-Looking or Forward-Looking?

Avoided emissions can be calculated as either backward-looking or forward-looking. Both methods calculate the per unit avoided emissions impact the same. When they scale up the unit impact, this is where they differ: in the case of backward-looking, last year's actual units sold are used and in the case of forward-looking, next year's expected units to be sold are used.

The genesis of backward-looking appears to come from the way a company reports its financials using the just completed fiscal year's financial information. When a company reports avoided emissions, this is the common approach used because all elements of the calculation are consistent with all other reported data.

The genesis of forward-looking comes from the GHG Protocol Project Standard which was designed to help project developers decide if a large-scale project will lead to reduced emissions and by how much. It helps with decision making.

How Can Avoided Emissions Be Standardized?

Standardization of avoided emissions can assist with comparability. Using a market average (a benchmark) as the reference case, instead of a specific product or service, may assist with comparability. The concept is similar to comparing a stock to an index instead of to another stock. By using the emissions of a market average as the reference case, the solution in question and others like it, can be compared to the same benchmark. (The GHG Protocol Project Standard provides detailed guidance on how to select candidates for a benchmark.)

What Are Common Mistakes in Calculating Avoided Emissions as per the GHG Protocol?

Failing to Use Comparable Products

This issue occurs most often when a claim is made comparing the emissions of two single products. When choosing products to compare, select one that the assessed product is most likely to replace in the marketplace, given expected customer behavior. For example, one might choose to replace a nonfuctioning gas furnace with an alternative in the market: a heat pump. Comparing emissions between the new heat pump and the old nonfunctioning gas furnace would be a mistake. Instead, the comparison should be between the selected heat pump and whatever product would have been the replacement had the heat pump *not* been selected—for example, a gas furnace that's currently available on the market.

Failing to Account for Every Stage of the Two Products' Life Cycle Emissions

This issue occurs most often when the emissions produced by a solution during one phase are low or zero and deemed to significantly outweigh emissions produced during the other life cycle phases of the solution. The comparison is made only on those phases that are seen to dwarf all others. Avoided emissions of any two products should account for every stage of their life cycle emissions—from

extraction of raw materials, production, processing and shipping, through to product use and end-of-life treatment. If data is unavailable for any life cycle phase, the GHG Protocol recommends filling the data gap with secondary data such as, industry average data, using data of a similar process as a proxy or estimating through analyses of financial data such as amount spent on process inputs, either specific to the process or industry average spend and improving that data as primary data becomes available. The GHG Protocol Product Life Cycle Accounting and Reporting Standard provides detailed guidance to understand the full life cycle emissions of a product and focus efforts on the greatest emissions-reduction opportunities.

Failing to Consider Changes in Consumer Behavior

This issue may occur in forward-looking avoided emission estimates when avoided emissions are scaled to calculate total impact. For example, when a company estimates that their product (the solution) can take all or a certain percentage of the market share and based on that potential market share, a certain amount of emissions would be avoided. However, it's possible that the introduction of the solution may create ripple effects that then increase or reduce emissions outside of the solution's life cycle. For example, while the introduction of a remote work and related products may reduce emissions from transportation and in-office emissions, there is the possible increase of home energy use and employees purchasing new or larger homes to accommodate home offices leading to the creation of emissions. This is often referred to as rebound effects or secondary effects of having implemented the solution and should be considered and qualitatively disclosed.

Confusing Market Size with Impact

This issue may occur in backward-looking avoided emissions when the impact of one unit is multiplied by the number of final products sold in the prior fiscal year. This analysis may ignore the fact that emissions are only avoided if the low-emission product is used in place of the reference product. For example, a new line of energy-efficient tablets may have lower life cycle emissions compared to a desktop computer. But if consumers are not using their new tablets to replace their less-efficient desktops and are instead using both products, the product is not avoiding emissions. When possible, when calculating avoided emissions, use actual sales numbers and reflect only the number of products estimated to replace existing or future stock. The emissions impact per single unit should be shown separately from results determined from scaling the product.

Inadvertently Cherry-Picking

This occurs when investors show the avoided emissions of the low-carbon products produced by their portfolio companies while ignoring the higher-emitting carbon products produced by those same portfolio companies. Analyses of total impact should represent the portfolio company's full product list, rather than a subset of products known or expected to have a positive impact. At a minimum, the percentage of portfolio company revenues attributed to the avoided emissions along with that same portfolio company's total carbon footprint, should be provided.

The Golden Rule: Always Be Transparent

To reduce concerns of greenwashing and to improve clarity and comparability, clear and complete information on how avoided emissions were calculated and what product or range of products were used for comparison should be provided. In addition, a complete corporate value chain inventory, including scope 1, scope 2, and scope 3 emissions of the portfolio company should be reported.

By being alert to common mistakes and always being transparent, the credibility of avoided emissions claims can be improved, potential accusations of greenwashing can be avoided, and confidence in the metric would increase and can lead to helpful value-added information being contributed to the internal decision-making process. And most importantly for us all, avoided emissions can play a key role in curbing emissions and fighting climate change.

Appendices

A • Definitions

Accounting approach The method or framework used to quantify, and report avoided emissions; This can be either attributional or consequential

Additionality The principle that the emissions reductions claimed as avoided emissions must be additional to what would have occurred in the absence of the project or action

Avoided emissions The expected emissions that a solution (e.g., a low-carbon product or service) prevents or saves with respect a higher-carbon or market average alternative product or service it replaces in the market

Backward-looking avoided emissions Estimates of past greenhouse gas emissions that have been avoided due to a project or action that has already been implemented

Carbon dioxide equivalent (CO_2e) A unit of measurement that expresses the global warming potential of different greenhouse gases in terms of the amount of carbon dioxide that would produce the same warming effect over a specified time

Climate solution Solutions aimed at mitigating climate change and its impacts, such as renewable energy deployment, energy efficiency measures, among others

Decarbonization The process of reducing or eliminating carbon dioxide emissions from various sources, often through transitioning to renewable energy sources, improving energy efficiency, and implementing other low-carbon technologies

Discounting The practice of adjusting future emissions reductions to their present value, considering factors such as time preference and uncertainty

Disposal emissions Greenhouse gas emissions resulting from the disposal or end-of-life treatment of products, such as emissions from landfill decomposition or waste incineration

Dynamic emission factors An emission factor that varies over time due to changes in technology, regulation, or other factors influencing emissions intensity

Emission factors Factors used to convert activity data into greenhouse gas emissions, specific to the type of activity and the greenhouse gas being measured

Forward-looking avoided emissions Estimates of future greenhouse gas emissions that are likely to be avoided because of implementing a project or action

Horizontal attribution The allocation of avoided emissions across different sectors or entities within a value chain

Impact time frame The period over which the effects of avoided emissions are assessed, which may vary depending on the context and objectives of the analysis

Life cycle emissions The total greenhouse gas emissions associated with a product, service, or process over its entire life cycle, including production, use, and disposal phases

Listed equity investor An investor who buys and sells shares of publicly traded companies listed on stock exchanges

Private equity investor An investor who invests in privately held companies, often with the goal of acquiring a significant ownership stake and eventually exiting the investment through a sale or public offering

Production emissions Greenhouse gas emissions generated during the manufacturing or production process of goods or services

Product life time The duration over which a product is expected to be used or consumed, influencing its life cycle emissions and potential for emissions reductions

Rebound effects Circumstance where some of the emissions reductions achieved by implementing a project or action are offset by increased emissions elsewhere in the system due to changes in behavior, technology adoption, or other factors

Reference case The amount of greenhouse gas emissions that would occur in the absence of a specific action or project, serving as a reference point for measuring avoided emissions

Static emission factor An emission factor that remains constant over time, typically used for simpler emission estimation methods or when emissions intensity is relatively stable

System-wide effects Broader impacts on emissions throughout an entire system resulting from the implementation of a project or action, including indirect effects on supply chains, markets, and consumer behavior.

Use emissions Greenhouse gas emissions associated with the use or consumption of goods or services, including emissions from energy consumption, transportation, and other activities related to product use

Venture capital investor An investor who provides funding to early-stage or startup companies with high growth potential in exchange for equity ownership

Vertical attribution The allocation of emissions reductions or avoided emissions to specific entities or activities based on investor financing

B • Methodological Landscape

Figures 11 and 12 below summarize the leading approaches to avoided emissions. These provide an assessment of their purpose, contributions to advancing the concept, and outstanding areas for methodological development.

Figure 11 • Emerging Methodological Landscape: Market Reports

Methodology	TPG	Lombard Odier and Rockefeller Foundation	GIC / Schroder's
Date	2022	2019	2017
Publication title	Evidence-based Impact in Climate	Carbon Yield Methodology	A Framework for Avoided Emission Analysis
Target audience	Shareholders	Shareholders	Shareholders
Approach and purpose	Describes the use of a decision tool for their "Rise Fund" investment decisions Provides an estimate of the impact efficiency of investing in each company	Outlines the Carbon Yield Methodology with the Rockefeller Foundation to identify a simple metric to quantify the GHG abatement impact of green bonds	Proposes a practical framework to measure and integrate avoided emissions into investment and portfolio analysis
Key contributions and differentiators	Exemplifies how avoided emissions can be used as a guide to investment decision Frames the assessment in the context of a financial institution Has a practical approach, recognizing how the assessment needs to feed the speed of a deal cycle	Provides a guide on how to calculate avoided emissions in the context of a green bonds Provides a list of simplified reference cases to use for frequent projects	Proposes an original and novel method for horizontal attribution Exemplifies the calculation with a clear and easy to follow example Identifies 19 key carbon-avoiding activities, providing estimated avoided emissions per unit and per dollar of revenue by each technology
Outstanding areas for methodology development	Limited to energy-related projects and assets Provides a partial view on the attribution approach for differentiated components; relevant where the impact of each component is not easily discernible	Best suited to the assessments carried out in the context of a green bond; its treatment of horizontal approach and impact time frame could be expanded to form a comprehensive methodology applicable outside the green-bond realm	Provides only a general view of the methodology with only a few references mentioning the tensions across methodological choices Offers a high-level overview of the methodology with minimal references to the challenges associated with various methodological decisions

Figure 12 · Emerging Methodological Landscape: Guidelines

Methodology	WBCSD	WRI	PRIME	Mission Innovation
Date	2023	2019	2017	2020
Publication title	Guidance on Avoided Emissions	Estimating and Reporting Avoided Emissions	Climate Impact Assessment for Early-Stage Ventures	The Avoided Emissions Framework
Target audience	Agnostic	Agnostic	Investors	Agnostic
Completeness	Encompasses most methodological choices	Partial coverage of methodological choices, excluding a step-by-step guide	Partial coverage of methodological choices, excluding attribution	Encompasses most methodological choices, but limited guidance on reporting
Approach and purpose	Focuses on improving credibility flagging issues, explaining tensions, and sharing best practices Provides a step-by-step guide for calculation	Focuses on improving credibility of claims and sharing recommendations Provides a high-level step-by-step guidance on calculation Addresses issues when assessing comparative impacts	Focuses on assessing and selecting new ventures based on environmental impacts Provides a high-level set-by-step guide for avoided emissions calculation but without attribution	Delivers a framework to classify and rank climate companies' solutions Provides a high-level step-by-step guide for avoided emissions calculations and in-depth worked examples to illustrate it
Key contributions and differentiators	Sets strict eligibility criteria specifying when avoided emissions be claimed Provides further considerations when choosing an average reference case to include changes in regulation Provides useful decision-tree to assist with selection of the reference scenario Guides that no allocation of avoided GHG emissions should be pursued; double counting avoided emissions between entities in a value chain is considered acceptable	Sets a dual eligibility criterion specifying when avoided emissions be claimed/calculated Provides detailed considerations when choosing life cycle emissions of the products being assessed Mandates avoided emissions should be reported separately from GHG inventories Includes a literature review and a reassessment of the impact of data quality on the uncertainty of the calculations	Offers a method to narrow down potential investment targets from a wide range of companies, focusing on their potential climate impact Considers the value of emissions overtime and emissions cannot be valued equally overtime, which other methodologies do not mention Dwells into the importance of additionality and the challenges when measuring it Outlines volume forecasting methods	Provides discussion of how volumes should be forecasted for different technological-readiness levels Provides in-depth, end-to-end examples to help guide calculations
Outstanding areas for development and enhancement	Does not factor in the duration of volume's data to be included in forward-looking calculation Lacks quantitative examples and easy to follow formulas to guide the calculation	Does not provide a comprehensive step-by step guide for investors	Attribution is missing from the methodology Only provides a limited guidance on how to choose the reference case	Only provides a limited view on when avoided emissions can be reported Only provides a limited view on the scope of emission factors to be included in the calculation

C • Additional Initiatives and Tools

PCAF work on avoided emissions In December 2022, PCAF launched the second version of the Global GHG Accounting and Reporting Standard for the Financial Industry. The most notable contribution has been to outline the distinction between avoided emissions and emissions removals, as well as their proposal for vertical attribution of avoided emissions based on equity and debt. In the future, PFAC is expected to work on transition finance and green finance. The latter should be monitored as it may contain new material on carbon accounting for avoided emissions and how they can be reported under green finance principles.

The CRANE Tool Prime Coalition, together with Rho Impact, developed the free to use CRANE Tool to standardize the way users assess the emissions reduction potential of early stage, innovative technologies, or companies. The CRANE Tool is an open-access tool with a comprehensive taxonomy. CRANE aggregates data for the user so the user does not need to reinvent the wheel every time they want to assess climate impact for an innovative technology. It provides standard output reports that allow the user to view annual emissions reduction potential, cumulative emissions reduction potential, market penetration, key calculation factors, and a heat map of scenarios. Investors are encouraged to try the CRANE Tool and visit its sister site, Project Frame, which has developed the methodology behind the CRANE Tool.

Climate Dividends Initiative Climate Dividends is a nonprofit whose mission is to make the measurement of ecological impacts more transparent, used and valued by the financial system; Encourage and value companies that offer solutions contributing to carbon neutrality; and Incentivize investors to fund those solutions. Climate Dividends is developing a protocol for companies that would enable the positive climate impact generated by a company to be claimed by the shareholders of the company as would a cash dividend.

Global Database of Emission Avoidance Factors Robeco and Mirova are working with Care by Bearing and Quantis to develop a for-profit global database of greenhouse gas emission avoidance factors, offering a standardized calculation of the emissions avoided. The database is expected to initially cover 80 specifically defined low-carbon solutions (such as biomass energy, recycled plastic, low-carbon concrete, etc.). The geographical differentiation of the reference scenarios taken into consideration for each solution and the various links in the value chains of these solutions will result in the creation of around 10,000 distinct avoidance factors during this first phase, which will end in Q4 2024.

Koi Rho Impact recently launched its commercial database of avoided emissions factors (AEFs), Koi. The platform is used to evaluate the future impact of climate technologies. A product of expert research, unique data, open methodologies, and AI, Koi provides an immediate view of avoided emissions over time across industries and regions. Koi's models deliver reliable, timely, and auditable data to support investors and entrepreneurs in achieving their net zero goals.

Locational Marginal Emissions In July of 2021, REsurety (in partnership with Microsoft) launched the Locational Marginal Emissions (LME) dataset, representing the first location-specific, hourly marginal emissions data available in the U.S. for electricity generation/consumption. Since then, this dataset has grown to cover all deregulated U.S. electricity markets, covering over 35,000 locations across the U.S. grid. LME data can be applied to electricity generation or consumption and quantifies the operational emissions avoided by each MWh of energy generated based on the specific time and location of clean energy generation. It can similarly be used to calculate the induced operational emissions associated with electricity consumption. This data has been validated against real-world observations.

D • Definitions of "Avoided Emissions"

Carbone4 Avoided emissions measure the contribution of an organization to the decarbonization of the economy outside the scope of its activities. Avoided emissions are estimated with respect to a counterfactual reference scenario that reflects the most probable situation that would have occurred in the absence of a low carbon solution.

GFANZ [Avoided emissions] are contributions to global decarbonization efforts outside of an entity's value chain through climate solutions and carbon removal projects.

GHG protocol Avoided emissions are emission reductions that occur outside of a product's life cycle or value chain, but as a result of the use of that product. Examples of products (goods and services) that avoid emissions include low-temperature detergents, fuel-saving tires, energy-efficient ball-bearings, and teleconferencing services. Other terms used to describe avoided emissions include climate positive, net-positive accounting, and scope 4.

Mission Innovation The overall concept of avoided emissions is that a solution (product or service) enables the same function to be performed with significantly less GHG emissions. The method of measuring avoided emissions is to compare a baseline scenario without the enabling solution with a scenario using the enabling solution, where the baseline represents the "business as usual" (BAU) scenario.

Prime Coalition A unit is an instance that quantifies an amount of product or service, which is used to compare a solution to an incumbent. Therefore, unit impact can be expressed as the difference in emissions between one unit of the incumbent and one unit of the solution. It is important to note that unit impact is not a constant: emissions from both the incumbent and the solution may change over time.

WBCSD An avoided emission is thus the difference between GHG emissions that occur or will occur (the "solution") and GHG emissions that would have occurred without the solution (that of the reference scenario).

WRI Comparative impact: the net difference in GHG emissions and removals between a base case without the assessed product and the case with the assessed product.